5. Notes on the Anatomy of *Dolichotis patagonica*. By Frank E. Beddard, M.A., Prosector to the Society.

[Received April 7, 1891.]

I am not acquainted with any paper dealing with the structure of this Rodent; the following notes may therefore be of some use.

Alimentary Canal and Viscera.

The *hard palate*, as in many Rodents, is narrow anteriorly, and the ridges are in consequence much reduced and modified. The accompanying drawing (fig. 1, p. 237) shows that they are only represented by two pad-like structures (*a*), each of which terminates in a pair of horny processes directed backwards; those of the posterior ridge are the longest. As the palatal ridges are characteristic in various Rodents, I have thought it worth while to illustrate their very peculiar form in *Dolichotis*. There are no ridges at all between the molar teeth; the mucous membrane is there perfectly smooth.

The *tongue* is divisible into two regions—a broadly oval tract behind and a narrow long anterior portion; the former has two circumvallate papillæ, and a large "Mayer's organ" on each side measuring about half an inch in length.

The *intestines* measure altogether 18 feet 6 inches.

The *cæcum* is large; it measures along the greater curvature, from the free extremity to the exit of the colon, about 18 inches; these measurements apply to the gut when distended with alcohol.

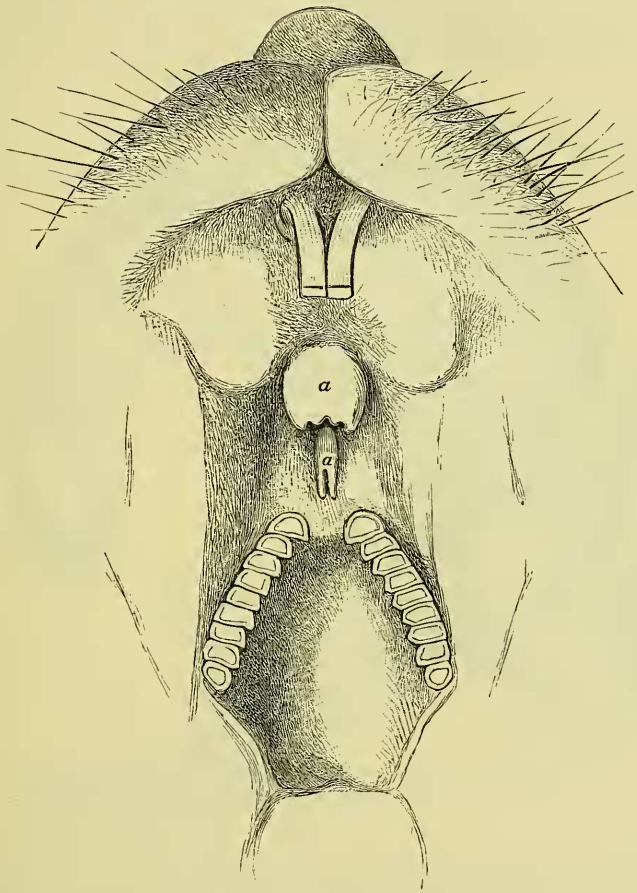
Its structure appears to be a little similar to that of the Capybara as described by Garrod[1]; both the ileum and colon open into a pouch separated by an incomplete valve from the rest of the cæcum; their apertures are not very close together, about an inch apart; the aperture of the colon is guarded by a sphincter. One lip of the ileo-cæcal orifice is formed by the fold which divides the cæcum proper from the colic pouch. From the sphincter valve of the colon three ridges like the typhlosole of the earthworm's intestine pass along its inner surface; these are in addition to the numerous closely-set fine ridges which traverse the first part of the colon running parallel to each other; these latter are very evident in the cæcum of the Paca, of which I have a dried specimen.

The first of these ridges can only be followed for a short way; the other two, on the contrary, extend for a very long way down. I

[1] "On the Cæcum coli of the Capybara (*Hydrochærus capybara*)" P. Z. S. 1876, p. 19. Garrod, however, states in that paper that "neither in *Cavia*, *Dolichotis*, *Capromys*, nor in any of the allied forms with which I am acquainted, does the strong sigmoid curve of the large intestine, at the commencement of the sacculated cæcum, develop into a true secondary cæcum in the manner that it does in the Capybara." The difference appears to be chiefly in the fact that the colon in Capybara is prolonged beyond its opening, thus forming the second cæcum; the arrangement in *Dolichotis* is more like that of *Erethizon* as figured and described by Mivart. I may mention that in *Sphingurus prehensilis* there is no such separation of the cæcum into two chambers.

traced them for the distance of one foot from the sphincter, but I do not know how much further they extended. These two ridges,

Fig. 1.



Palate of *Dolichotis patagonica*.

a, processes upon palate representing palatal ridges.

as shown in the accompanying drawing (woodcut, fig. 2), are at first some distance apart (about $\frac{3}{4}$ of an inch); they become gradually closer until they are only separated by a little less than half an inch; they then run parallel. These ridges are clearly very like those of *Aulacodus swindernianus* figured and described by Garrod[1]; they are

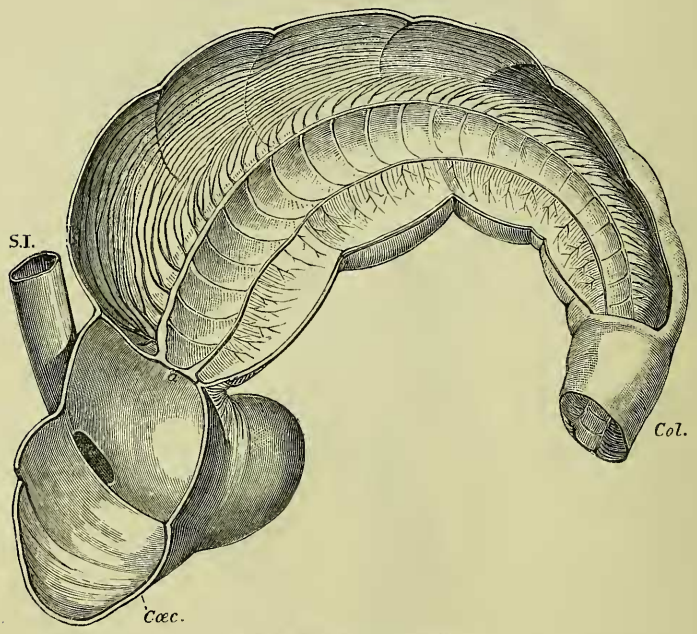
[1] "On the Visceral Anatomy of the Ground Rat (*Aulacodus swindernianus*)," P. Z. S. 1873, p. 786.

slightly "puckered" in the same way, and posteriorly run parallel to each other "like railway-lines"; but in *Dolichotis* the intestine is sacculated between these two bands, which causes the appearance of a number of transverse ridges between them like railway-sleepers.

The cæcum has externally, as in *Erethizon*, three longitudinal bands; its extremity is blunt.

The *liver* is not unlike that of the Porcupine, though the proportions

Fig. 2.



Portion of colon and cæcum of *Dolichotis patagonica*.

a, valve of colon; *Cæc.*, commencement of cæcum; *S.I.*, small intestine; *Col.*, colon.

of the lobes are a little different. The left lateral lobe is the largest; the right and left centrals are about equal to each other and to the right lateral; the lobes are not much divided, the caudate and Spigelian are well-marked; a gall-bladder, so variable in its occurrence in Rodents, is present.

The *heart* gives off *one* innominate artery.

The *lungs* are made up of two lobes on the left and three on the right side besides the lobus impar; the upper lobe of the left side is nearly divided into two.

The right *kidney* is a little in advance of the left, about half an inch.

The *generative organs* have large vesiculæ seminales, each about 3 inches in length.

Some of the Muscles.

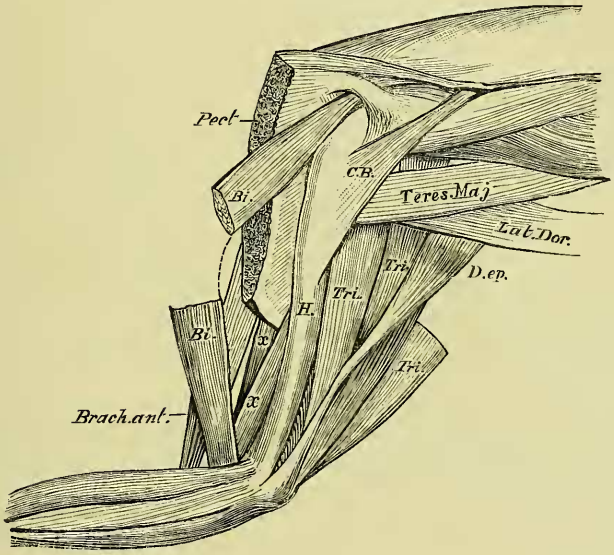
In dissecting the muscles of *Dolichotis* I have confined myself to those of the limbs and for the most part to the flexors and extensors of the limbs.

I commence by describing those muscles which I have dissected, and shall presently point out the resemblances to other Rodents.

Muscles of the Fore Limb.

The *Trapezius* is a very extensive muscle, its origin extends back as far as the last rib; it is continuous in front with a strongly tendinous fascia which passes into a thick layer of muscle, forming thus an almost separate anterior portion of the muscle. The hinder

Fig. 3.



Arm muscles of *Dolichotis patagonica*.

Pect., pectoralis primus; *C.B.*, coraco-brachialis; *Bi.*, biceps; *Brach. ant.*, brachialis anticus; *Tri.*, triceps; *Lat. Dor.*, latissimus dorsi; *D. ep.*, dorso-epitrochlear; *H.*, humerus; *Teres Maj.*, teres major; *x*, second part of brachialis anticus.

part of the trapezius is attached to about the middle of the spine of the scapula; this insertion is continuous with that of the anterior part of the muscle, which is to the metacromion and by fascia on to outer muscles of humerus; this insertion is partly covered by that of the panniculus carnosus.

The *Latissimus dorsi* is not attached to the infraspinatus, as it is stated to be in the Agouti by Messrs. Murie and Mivart; its

insertion is on to humerus by tendon in common with the teres major; it gives off, as is so usually the case in this group of animals, a *dorso-epitrochlear* slip which runs to elbow.

The *Teres major* arises from about the upper half of the posterior margin of the scapula; it is inserted, as already mentioned, in common with the latissimus dorsi by a flat tendon about half an inch long and rather more than half an inch broad at its insertion.

The *Deltoid* consists of two more or less distinct portions—one arising from the spine of the scapula and apparently also from the fascia covering the infraspinatus; the smaller part of the muscle springs from the acromion and metacromion; the two are inserted in common on to the deltoid ridge by an insertion which is fleshy above but tendinous below.

The *Pectoralis primus* is much blended with the panniculus carnosus; its insertion is shown in the accompanying drawing (woodcut, fig. 3) to extend a long way down the humerus.

The *Triceps* consists of four distinct parts, or of five if the dorso-epitrochlear be reckoned as belonging to the *Triceps*. The first part arises from scapula and also from the fascia covering the infraspinatus; the second part is blended at its origin with the insertion of the infraspinatus; it arises from the neck of the humerus and from the deltoid ridge. The third part is smaller; its origin is tendinous from the neck of the humerus just below the insertion of the teres major and latissimus dorsi. The fourth part is entirely fleshy and arises from the greater part of the shaft of the humerus.

The *Coraco-brachialis* arises from the coracoid by a strong flat tendon; its insertion is also tendinous for the greater part and extends for some way down the humerus, beginning with the head; the posterior part of its insertion is fleshy.

The *Biceps* has only a single origin and a single insertion on to the ulna.

The biceps is also inserted in common with a peculiar muscle shown in the accompanying drawing (woodcut, fig. 3, *x*); this muscle arises by two fleshy heads from the humerus, one on either side of the insertion of the pectoralis.

The *Brachialis anticus* curves round the arm as it does in other Rodents; it has a tendinous insertion on to the ulna beyond that of the biceps.

The *Pronator radii teres* is not a very strong muscle; it arises from the outer condyle of the humerus and is inserted on to the radius.

The *Flexor metacarpi radialis* is the next muscle to the pronator radii teres; it is attached by a long tendon to the second metacarpal (= 3rd digit) near to the proximal end.

The *Flexor carpi ulnaris* is attached in the usual way by a very stout tendon.

The *Flexor sublimis* arises in common with the flexor profundus; it divides into three delicate tendons which supply digits 2, 3, and 4.

The *Flexor profundus* and *Flexor pollicis longus* are difficult to distinguish; the common tendon arises from the fusion of four more or less distinct muscular heads. Two of these arise from the

condyle of the humerus, one of them (the more superficial) being much larger than the other. The two remaining heads arise respectively from the radius and ulna.

The *Extensor metacarpi radialis* is a large muscle, the largest of the extensors; its tendon is inserted on to outer side of metacarpal of 3rd digit, having previously given off a slip to the head of the first metacarpal (*i. e.* that of 2nd digit).

The *Extensor communis digitorum* arises not only from the external condyle of the humerus, but also by a few fibres from the ulna; its tendon splits at the wrist into four tendons supplying the four digits.

The *Extensor minimi digiti* is the smallest of the three upper extensors; it arises from extensor condyle and from ulna; it supplies 4th and 5th digits.

The *Extensor carpi ulnaris* calls for no special remark; it is as in the Agouti.

These are all the extensors of the manus of *Dolichotis*.

Muscles of the Hind Limb.

The *Gracilis* consists of two distinct parts as in other Rodents. One part of the gracilis is sometimes spoken of as *sartorius*; the muscle is inserted on to fascia covering leg from knee to ankle-joint; it also appears to have a tendinous connection with both the semimembranosus and semitendinosus.

The *Semitendinosus* is a strong and fleshy muscle; it arises from the spines of the sacral vertebræ and from the tuberosity of the ischium; it is inserted by a moderately broad flat tendon, which becomes thicker at its insertion to outside of cnemial crest of tibia.

The *Biceps* has two origins—(1) from sacral vertebræ in front of the semitendinosus and continuous with it; (2) from tuberosity of ischium, also in front of semitendinosus. It is inserted by a continuous broad sheet of muscle on to fascia covering leg.

The *Tibialis anticus* arises by two heads—(1) by a long tendon from the femur which passes beneath the patello-tibial ligament; (2) by a fleshy head from tibia and fibula. The two parts are blended a short way down and inserted by a strong tendon on to inner side of inner metacarpal.

The *Extensor communis* arises by a long tendon from the femur; its tendon of insertion passes under two annular ligaments, one at ankle-joint through which the tendon of the tibialis anticus also passes, and another near the proximal end of the metacarpal; just before passing through the second annular ligament the tendon splits into two; each of these again splits into two; the two outer of the four tendons supply the two outer digits; the two inner ones both go to the middle digit.

The *Extensor hallucis* is a slender muscle arising from the tibia and fibula; its tendon does not pass through the lower annular ligament; it supplies the second digit.

The *Extensor brevis* is a small flat triangular muscle, two tendons arise together from the muscle and supply the two inner digits.

The only Peroneal muscles present are the *Peroneus longus* and the *Peroneus quarti digiti*; the latter has an attachment to ankle as well as to 4th digit.

There are three long flexors.

The *Flexor communis* overlies the *Tibialis posticus*; their tendons join at the ankle; the tendon of the *Flexor hallucis* joins the common flexor tendon a little further down just before its trifurcation. *Interossei* form a thick mass covering sole of foot. There is only *one Lumbricalis* arising from flexor tendon of outer digit.

The myology of the Guinea-pig is to a considerable extent described by Messrs. Murie and Mivart in their memoir upon the Agouti[1]; it presents a number of differences from *Dolichotis*, of which the following are the principal:—

(1) There is no second part to the brachialis anticus, arising from the humerus[2].
(2) The Triceps has only three heads.
(3) The Flexor sublimis has four tendons.
(4) There are several extensor muscles of the hand not present in *Dolichotis*.
(5) Peroneus brevis present.

In most of these points *Dolichotis* also differs from the Agouti—in all except as to the second part of the *Brachialis anticus* (see foot-note).

On the whole in myology *Dolichotis* is nearer to the Agouti than to the Porcupines, but it differs from both in the reduction of the extensors of the manus and the peroneal muscles.

There are at present so few Rodents of which the myology is known that I do not propose to deal with the resemblances of *Dolichotis* to such types as are known at greater length.

Brain.

As there is no description known to me of the brain of this Rodent and no figures, I endeavour to supplement this deficiency.

The brain (see fig. 4, p. 243) measures 59 mm. in length (to the end of the cerebellum) and 41 mm. greatest breadth.

The corpora quadrigemina are well exposed, as is the case with most Rodents, but not in the Squirrel and Porcupines.

The cerebral hemispheres are provided with well-marked sulci, which are more numerous than in a brain of *Cœlogenys paca* of about the same size.

The relation between the size of the animal and the complexity of the cerebral convolutions is not so plain in the Rodents as in some other groups; the Porcupines form the principal exception; they have all very smooth brains, as compared with other Rodents of a similar size or even smaller.

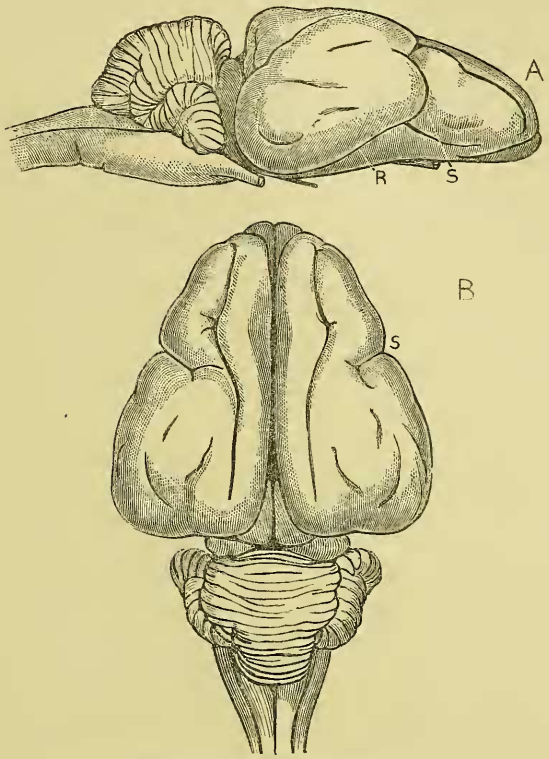
The Rhinal fissure of *Dolichotis* is deeper behind than in front;

[1] P. Z. S. 1866, p. 383.

[2] I think that the muscle which I figure (woodcut, fig. 3, *x*) must correspond to the one so named in the Agouti, though its insertion is quite different in *Dolichotis*.

the Sylvian fissure is very deep; it passes forwards and then backwards, forming a line which is convex anteriorly; after this it bends forwards at a sharp angle and nearly joins the principal longitudinal sulcus (see fig. 4). The upper surface of each cerebral hemisphere is marked by a strong sulcus running with a sinuous outline approximately parallel to the long axis of the brain; these sulci commence a little way in front of the hinder margin of the

Fig. 4.



Brain of *Dolichotis patagonica*.

A, from the side; B, from above: *S*, sylvian fissure; *R*, rhinal fissure.

brain; anteriorly each bends outwards and joins the rhinal sulcus; the other fissures are of less importance and are illustrated in the drawing exhibited (fig. 4).

I have been able to compare the brain of this species with those of the following Rodents at present in my possession:—

Castor fiber (a cast of the brain [1]),

[1] For this and several other casts of the brain itself, *not* of the cranial cavity, I am greatly indebted to Prof. d'Arcy Thompson.

Lepus cuniculus,
Sciurus vulgaris,
Cœlogenys paca,
Sphingurus prehensilis,
Cavia porcellus,
Lagostomus trichodactylus,

and with the following Rodents known to me only by descriptions and figures :—*Erethizon dorsatus* (Mivart, "Notes on the Anatomy of *Erethizon dorsatus*," P. Z. S. 1882, p. 250, woodcut fig. 7); *Pectinator spekii* (Peters, "Contributions to the Knowledge of *Pectinator* &c.," Trans. Z. S. vol. vii. p. 405, pl. 50. figs. 7–10); *Hystrix* (Owen, 'Comp. Anat. of Vertebrates,' vol. iii. p. 110, fig. 77, and Gratiolet and Leuret, Comp. Anat. Syst. nerv. pl. iii. figs. 1, 2); *Castor*, Agouti, Paca, Water-Rat, Squirrel, Rabbit (all figured in the work just referred to).

In comparing the brain of *Dolichotis* with those of the other types mentioned in the above list, I have paid particular attention to the classificatory importance of this structure. The primary division of the Rodentia into *Duplicidentati* and *Simplicidentati* is borne out by the characters of the brain. In the brain of the Rabbit the lateral lobes of the cerebellum form an angle with the middle lobe and reach rather further forward, while the flocculi stand out prominently. The rhinencephalon is sharply bent down, and the posterior half forms an exceedingly prominent convex projection. These characters are not met with in the other genera that I have examined. At the same time I cannot find any characters except negative ones that bind together the Simplicidentati.

Lagostomus and *Cœlogenys* are most like *Dolichotis*, but in the two former the furrow dividing the external gyrus is broken in the middle. In *Cœlogenys* the Sylvian fissure is hardly marked, but the rhinal fissure is exceedingly deep; *Cœlogenys* shows a further point of agreement with *Dolichotis* in the presence of a supraorbital sulcus; this extends further back, running parallel with the rhinal fissure in *Dolichotis*. The most important fissure in the pallium of the Rodent's brain is clearly the one which bounds the external gyrus. In the Rabbit and Guinea-pig, which have nearly smooth brains, traces of this furrow exist for a short extent posteriorly. Probably the dints on the upper surface of the brain in the Porcupines are still further reduced traces of the same furrow. I may take this opportunity of mentioning that the brain of *Sphingurus prehensilis* agrees very closely with Mivart's description and figures of the brain of *Erethizon dorsatus*. I cannot indeed detect any point in which they differ.

On the whole it seems that the anatomy of *Dolichotis* brings it into relation with the Agoutis rather than the Porcupines.